Claims

1. A method for partitioning video data into a base layer and at least one enhancement layer, comprising the steps of:

separating the video data into a plurality of frames (10);

separating each frame into a plurality of blocks (10);

determining DCT coefficients for the blocks (10);

for each block,

quantizing the DCT coefficients (10),

converting the quantized DCT coefficients into a set of (run, length) pairs at least a portion of which lie on a convex hull (10),

determining a partitioning point by analyzing the slope of lines only between adjacent pairs of (run, length) pairs which lie on the convex hull (12, 14, 16); and

encoding only those (run, length) pairs before and inclusive of the partitioning point into a transmission of a base layer and encoding those (run, length) pairs after the partitioning point into a transmission of at least one enhancement layer (18).

2. The method of claim 1, wherein the step of determining the partitioning point (12, 14, 16) comprises the step of analyzing the slope of lines only between adjacent pairs of (run, length) pairs which lie on a causally optimal convex hull such that the causally optimal convex hull is determinable synchronously upon encoding the (run, length) pairs and decoding the (run, length) pairs.

3. The method of claim 2, wherein the step of determining the partitioning point (12, 14, 16) comprises the steps of:

determining the slope of lines between all adjacent pair of the (run, length) pairs (12);

determining which of the (run, length) pairs lie on the causal convex hull based on the slope of the lines between the adjacent pairs of (run, length) pairs (14); and then

determining the partitioning point based on the slope of the lines between the adjacent pairs of (run, length) pairs which lie on the causal convex hull (16).

4. The method of claim 3, wherein the step of determining the partitioning point (12, 14, 16) based on the slope of the lines between the adjacent pairs of (run, length) pairs which lie on the causal convex hull comprises the step of comparing the slopes of the lines relative to a quality factor common to all of the blocks in each frame.

5. The method of claim 4, further comprising the step of placing the quality factor in a header of the frame.

6. The method of claim 3, wherein the partitioning point is determined based on the slope of the lines between the adjacent pairs of (run, length) pairs which lie on the causal convex hull and on a quality factor common for all blocks in a frame.

7. The method of claim 3, wherein the step of determining which of the (run, length) pairs lie on the causal convex hull (14) comprises the steps of:

for each of the (run, length) pairs except for the first and last (run, length) pairs in the set,

determining a distortion-length slope between that pair and a preceding pair and between that pair and a following pair; and

determining whether the distortion-length slope between that pair and the following pair is less than the distortion-length slope between that pair and the preceding pair, and if so, considering that pair to lie on the causal convex hull.

8. The method of claim 7, further comprising the step of:

forming a causal convex hull set from the (run, length) pairs determined to lie on the causal convex hull and the first pair in the (run, length) set.

9. A scalable video system (20), comprising:

a source encoder (22) for encoding video data and outputting encoded data comprising a base layer and at least one enhancement layer, said encoder being arranged to

separate the video data into a plurality of frames;

separate each frame into a plurality of blocks;

provide a header for each frame;

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determine DCT coefficients for the blocks;

for each block,

quantize the DCT coefficients,

convert the quantized DCT coefficients into a set of (run, length) pairs,

determine a partitioning point by analyzing the slope of lines only between adjacent pairs of (run, length) pairs which lie on the causal convex hull, and

encode only those (run, length) pairs before and inclusive of the partitioning point into a transmission of the base layer and encoding those (run, length) pairs after the partitioning point into a transmission of the at least one enhancement layer.

10. The system of claim 9, wherein said encoder (22) is arranged to determine the partitioning point by analyzing the slope of lines only between adjacent pairs of (run, length) pairs which lie on a causally optimal convex hull such that the causally optimal convex hull is determinable synchronously upon encoding the (run, length) pairs and decoding the (run, length) pairs.

11. The system of claim 10, wherein said encoder (22) is arranged to determine the partitioning point by determining the slope of lines between all adjacent pairs of the (run, length) pairs, determining which of the (run, length) pairs lie on the causal convex hull based on the slope of the lines between the adjacent pairs of (run, length) pairs, and then determining the partitioning point based on the slope of the lines between the adjacent pairs of (run, length) pairs which lie on the causal convex hull.

12. The system of claim 11, wherein said encoder (22) is arranged to determine the partitioning point based on the slope of the lines between the adjacent pairs of (run, length) pairs which lie on the causal convex hull by comparing the slopes of the lines relative to a quality factor common to all of the blocks in each frame.

13. The system of claim 9, wherein said encoder (22) is arranged to determine the partitioning point based on a common quality factor for all block in a frame.

14. The system of claim 10, wherein said encoder (22) is arranged to determine

which pairs lie on the causal convex hull by determining a distortion-length slope between each pair on the causal convex hull and a preceding pair and between that pair and a following pair and determine whether the distortion-length slope between that pair and the following pair is less than the distortion-length slope between that pair and the preceding pair, and if so, considering that pair to lie on the causal convex hull.

15. The system of claim 9, further comprising

a source decoder (28) for decoding video data comprising the base layer and at least one enhancement layer and outputting decoded data, said decoder (28) being arranged to analyze the (run, length) pairs in the base layer and in the at least one enhancement layer to determine the partitioning point for use in decoding the video data.

16. The system of claim 15, wherein said decoder (28) includes a memory (30) which stores computer-executable process steps and a processor (32) which executes the process steps stored in said memory (30) so as to (i) receive the base layer and the at least one enhancement layer, and (ii) determine a partitioning point based on the (run, length) pairs included in the base layer and in the at least one enhancement layer by analyzing only causal (run, length) pairs.

17. The system of claim 9, wherein said encoder (22) includes a memory (24) which stores computer-executable process steps and a processor (26) which executes the process steps stored in said memory (24) so as to determine a partitioning point by analyzing the slope of lines only between adjacent pairs of (run, length) pairs which lie on a causal convex hull and include in the base layer only the (run, length) pairs before and inclusive of the partitioning point and include in the at least one enhancement layer the (run, length) pairs after the partitioning point.

18. A scalable encoder (22) capable of partitioning data into a base layer and at least one enhancement layer which include data representing (run, length) pairs for a plurality of macroblocks in a video frame, the encoder comprising:

a memory (24) which stores computer-executable process steps; and

a processor (26) which executes the process steps stored in said memory (24) so as to

determine a partitioning point by analyzing the slope of lines only between adjacent pairs of (run, length) pairs which lie on a causal convex hull and include in the base layer only the (run, length) pairs before and inclusive of the partitioning point and include in the at least one enhancement layer the (run, length) pairs after the partitioning point.

19. The encoder of claim 18, wherein said processor (26) is arranged to determine the partitioning point by (i) determining the slope of lines between all adjacent pairs of the (run, length) pairs, (ii) determining which of the (run, length) pairs lie on the causal convex hull based on the slope of the lines between the adjacent pairs of (run, length) pairs, and then (iii) determining the partitioning point based on the slope of the lines between the adjacent pairs of (run, length) pairs which lie on the causal convex hull.

20. A scalable decoder (28) capable of merging data from a base layer and at least one enhancement layer which include data representing (run, length) pairs for a plurality of macroblocks in a video frame, the decoder (28) comprising:

a memory (30) which stores computer-executable process steps; and

a processor (32) which executes the process steps stored in said memory (30) so as to (i) receive the base layer and the at least one enhancement layer, and (ii) determine a partitioning point based on the (run, length) pairs included in the base layer and in the at least one enhancement layer by analyzing only causal (run, length) pairs.